MAN SEES STARS in true color for the first time. North American Nebula (page 295) is so named because it looks like the continent. Andromeda Galaxy (above companion and near twin of Milky Way (the galaxy that contains our solar system.) Below, Crab Nebula, the outrushing remnants of a dying star whose explosion was seen on Earth in 1954 A.D., radiates red and white light.

THE STARS IN COLOR

THROUGHOUT the course of history most men gazing into the night sky have seen stars as white or pale yellow against an inky background and have thought that that was all the color there was. The colors are there, nonetheless, and astronomers constantly study them. The reason man fails to see much color in the night sky is because he loses the power to discriminate between one wave length or color and another when the illumination is low. Now for the first time we have reasonably accurate color photographs of some of the most impressive wonders of space. They are far more spectacular than color pictures of the planets, which show only pallid hues.

Invisible to the eye, the radiant colors on the opposite page and page 295 are accurately presented with the use of newly developed supersensitive film. William C. Miller, Research Photographer for the Mount Wilson and Palomar Observatories, Pasadena, California, who took these photographs, spent two years testing the color fidelity and balance of specially sensitive Ansco films, finding out how to make them record accurately the visible spectrum while blocking most of the invisible ultraviolet rays. Now, as Astronomer Rudolph L. Minkowski said when he first inspected Miller's pictures, "With these you can see at a glance things that you would take hours finding with the old black and white photographs."

Even with the development of Super Anscochrome, such finely detailed photographs could not have been taken except with the 200-inch Hale and the 48-inch Schmidt, the unique telescopes on Palomar Mountain operated jointly by the California Institute of Technology and the Carnegie Institution of Washington. Both these telescopes are in reality cameras. Consequently, for astronomer and layman alike, the beauties of the heavens are here revealed in unparalleled spendor. Their subtle details and blending hues are perceived only through the camera's eye, for the human eye will never see them directly, even through the world's most powerful telescopes.

J. R. Eyerman, courtesy Life © 1959 Time, Inc.

IN 200-INCH telescope, William C. Miller sits in cage at muzzle end handling plate holder for color film.

THE MOON

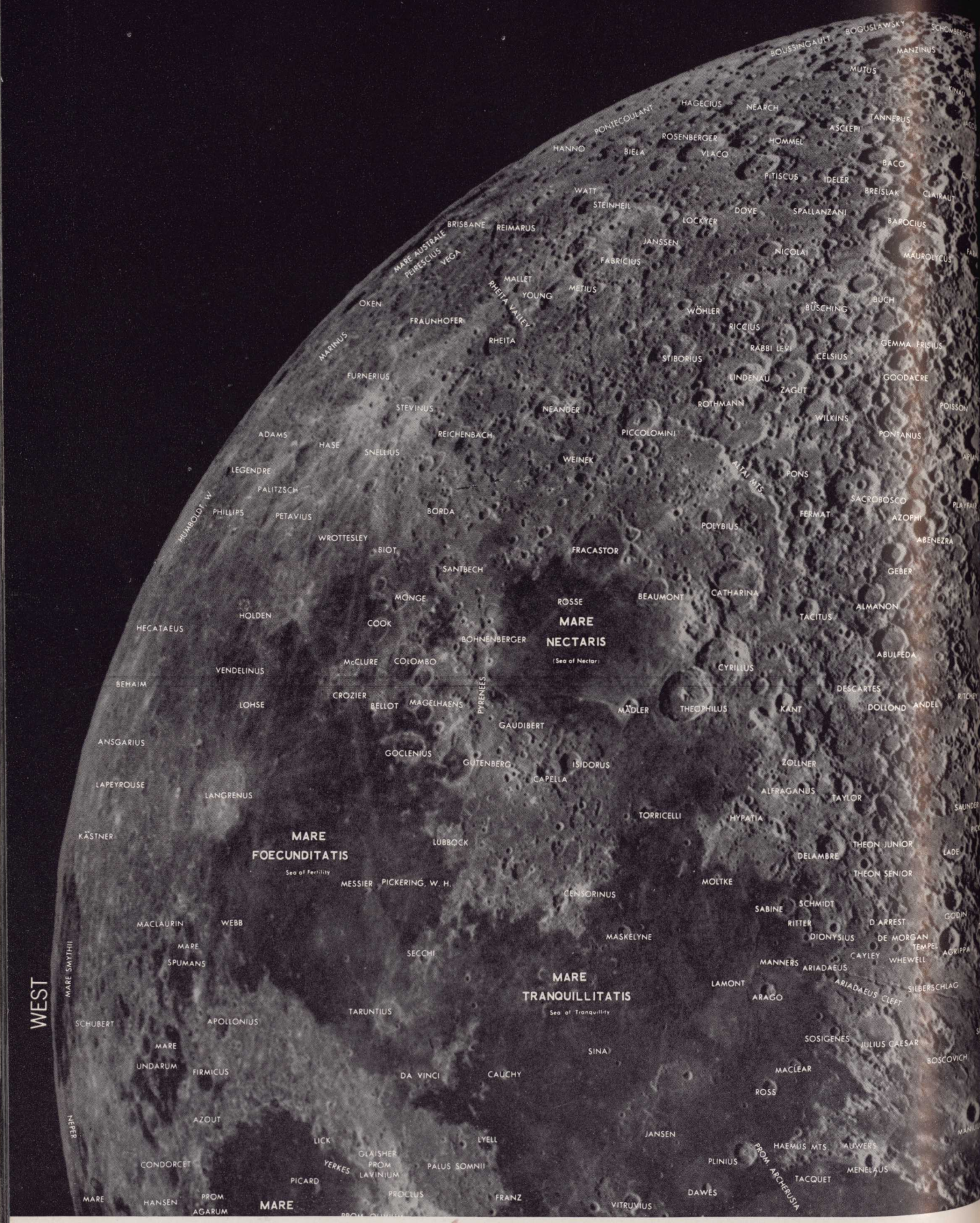
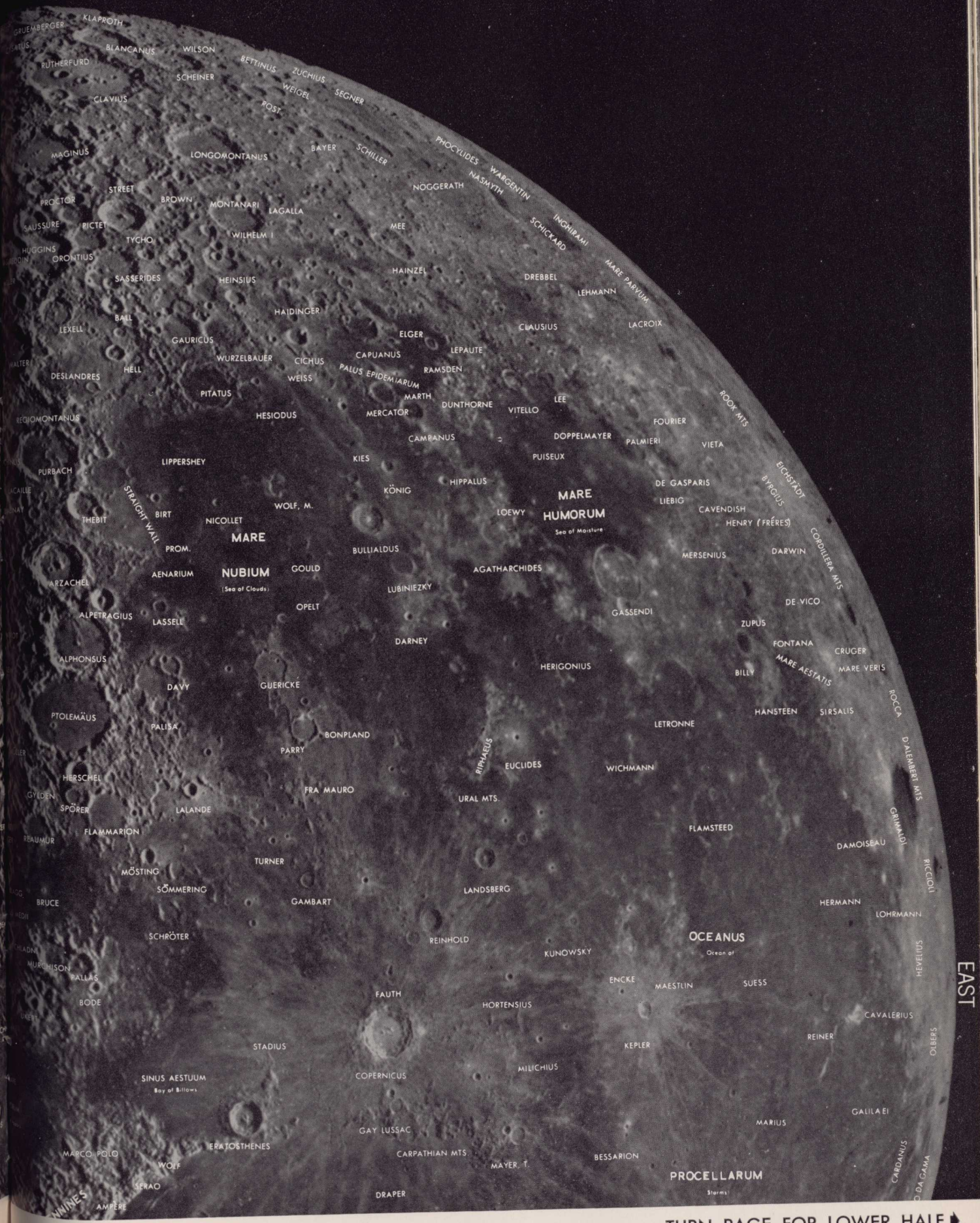
PREHISTORIC man, crouching at the mouth of his cave, looked up into the night sky and regarded the moon with great awe. Eons later, the moon became part of man's early theology, a role it retained until the first astronomers peered through their telescopes and recognized that the goddess Luna was actually a celestial body not unlike the earth. From that time on, the moon's status as a deity declined but its nearness to earth made it an intriguing subject for intense astronomical study.

Today, the moon is an alluring first frontier for man's exploration of space. Not only is Luna our nearest celestial neighbor and hence the easiest to reach, but its low gravity will permit space vehicles to land and take off from its surface with a minimum expenditure of fuel. Thus, a manned space craft for a round trip to the moon would require much smaller reserve fuel supplies and so would be easier to launch from earth than would one for, say, Venus or Mars.

Why explore the moon? First of all, scientists hope that study of the moon's geology will provide many clues to earth's history, since it is assumed that our earth and its satellite had similar origins. The physical characteristics of the moon's surface, unlike those of earth, have not suffered from ages of erosion by water, wind, and weather. Absence of any appreciable atmosphere on the moon suits it ideally as a base for advanced astronomical study of the planets, sun, and other stars, since haze, wind, and other causes of optical distortion are absent.

Use of the moon as a base for military surveillance of the entire earth has been suggested; it could serve equally well as a weather observation or radio-relay station. In the more distant future, a moon-port may serve as a way-station for space vehicles bound for the planets and beyond. The discovery of valuable minerals on the moon is another possibility, and such a discovery may lead to the successful commercial exploitation of these deposits.

The extension of many present activities at General Electric's Missile and Space Vehicle Department (who supplied us with the map and this information) are applicable to the forthcoming exploration of the moon. The map of the moon, which appears on the four following pages can be had (35x45 inches) by writing to Stafford Industries, Inc., P.O.B. 702, Devon, Pa. and enclosing one dollar.

Russia added to her list of space conquests by hitting the moon last September. At the time of impact, the sphere was traveling at 9,000 mph and the moon was swinging through space at 2,180 mph. It landed in the area of Autolychus, Archimedes and Aristillus and was called Lunik II. It was a triumphant end for Lunik II, after crossing nearly one-quarter million miles of space, it crashed on the moon less than 1½ minutes behind schedule, transit time was 37 hours.

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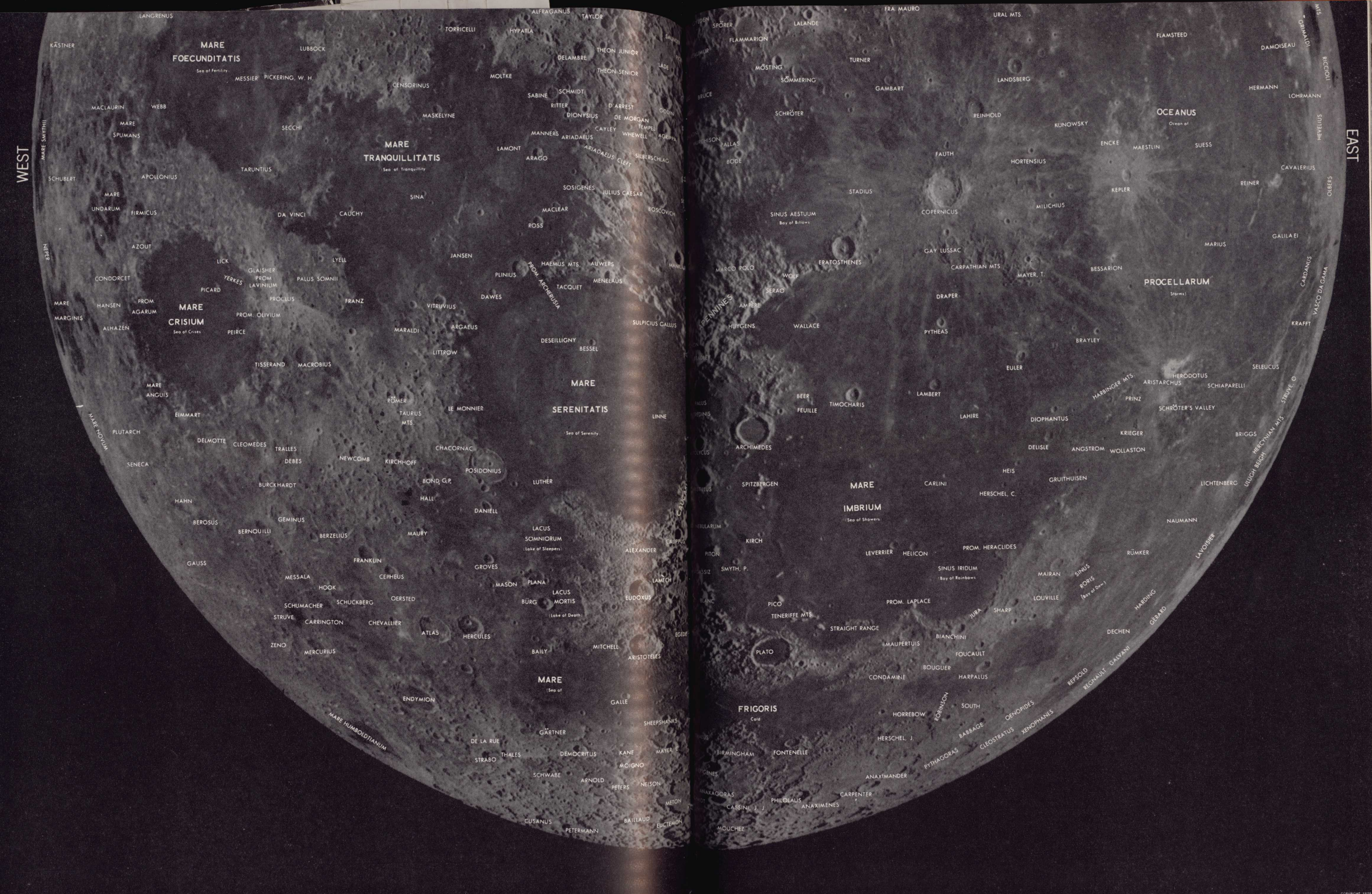
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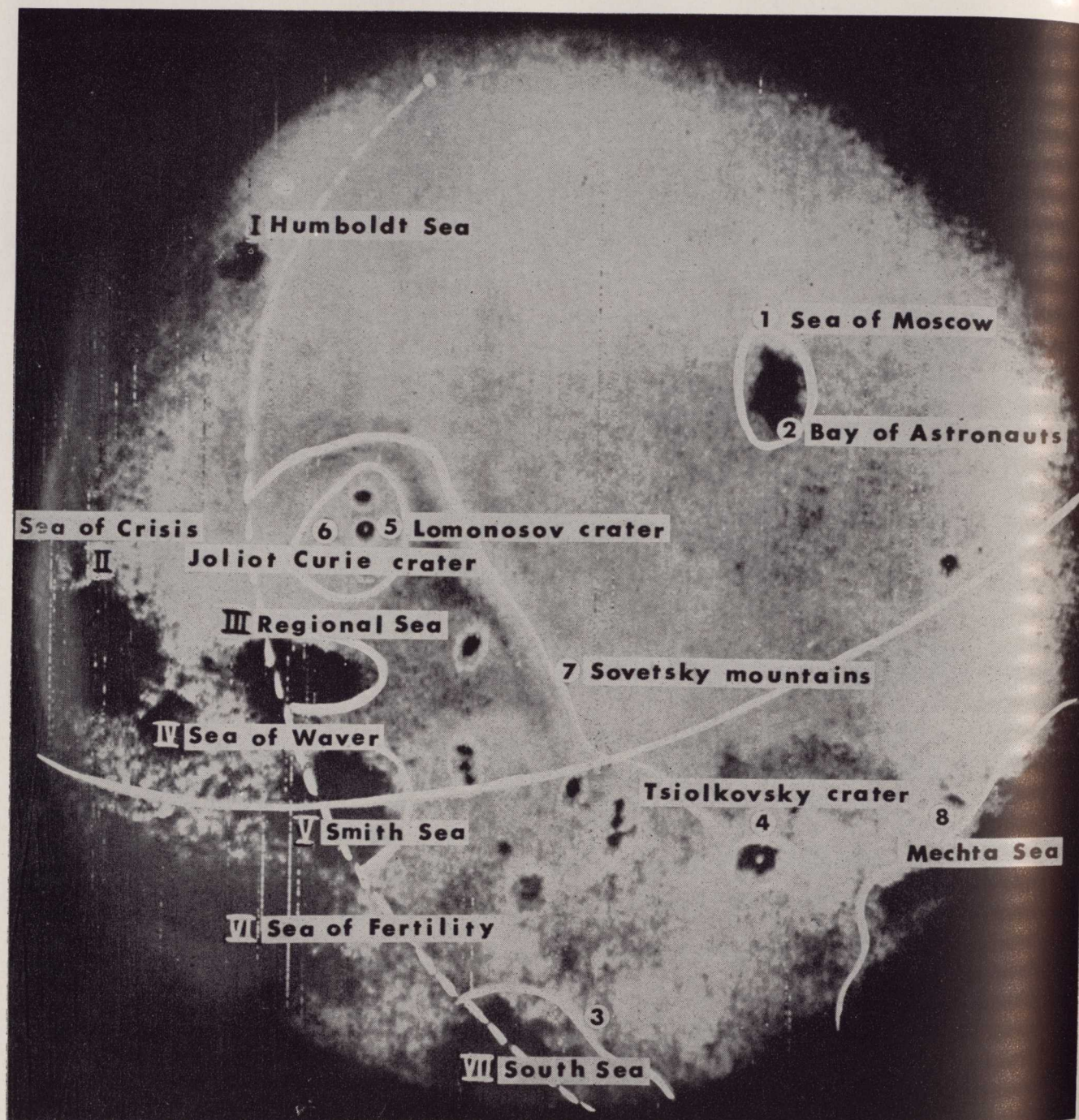
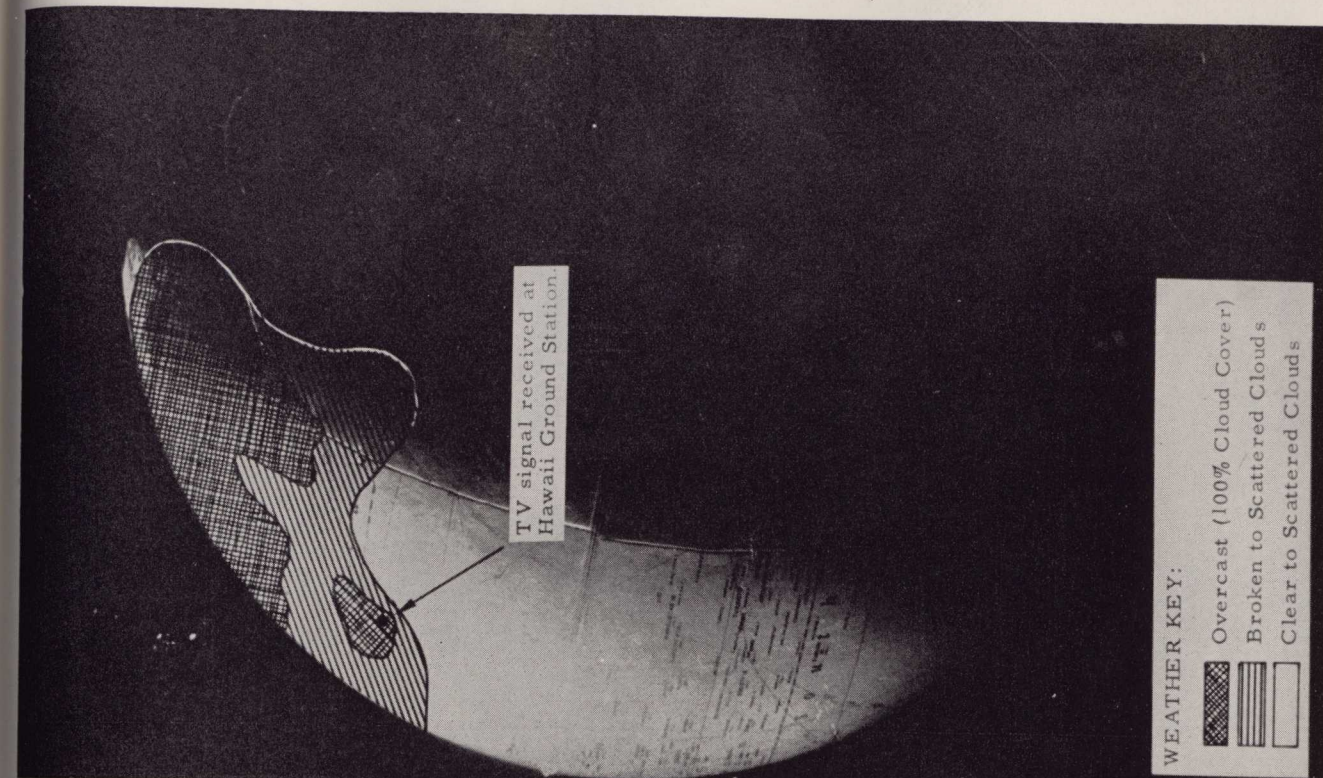
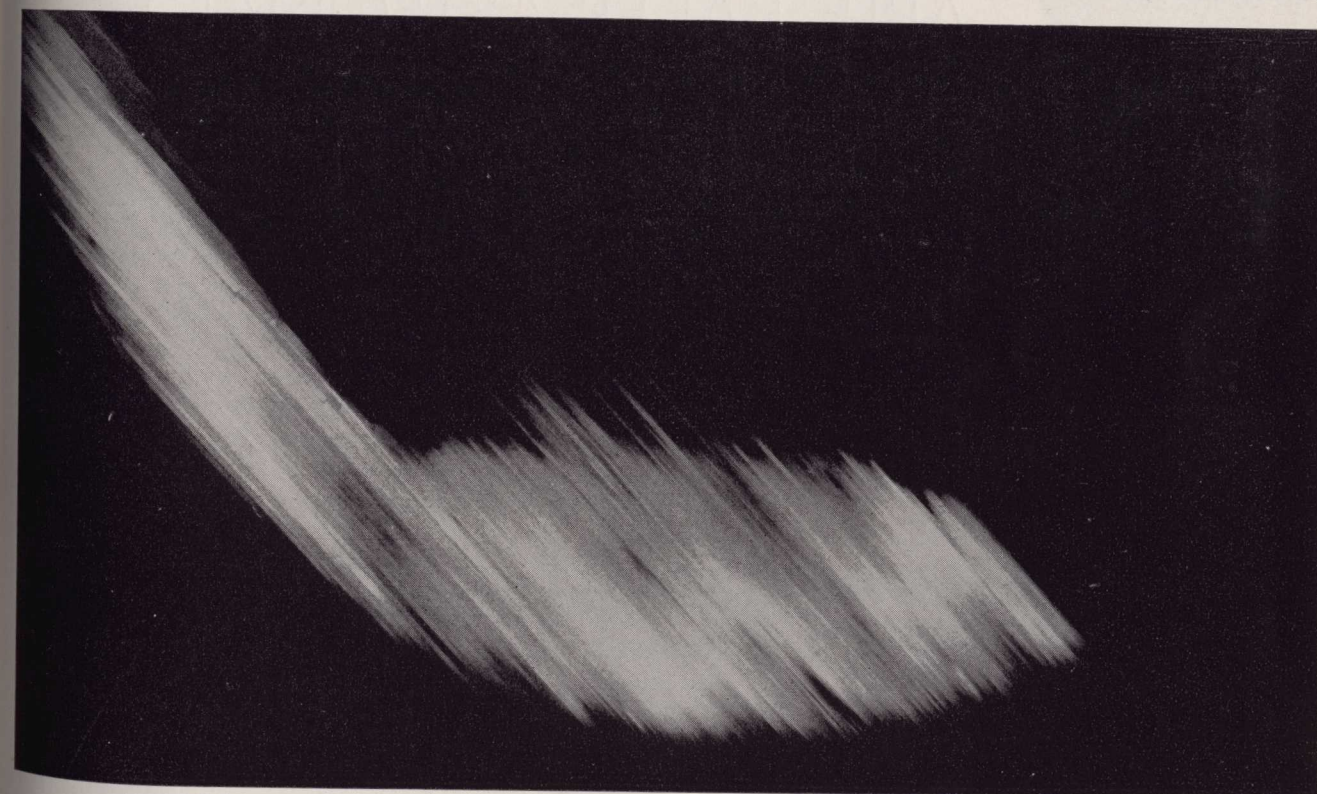

United Press International Photo

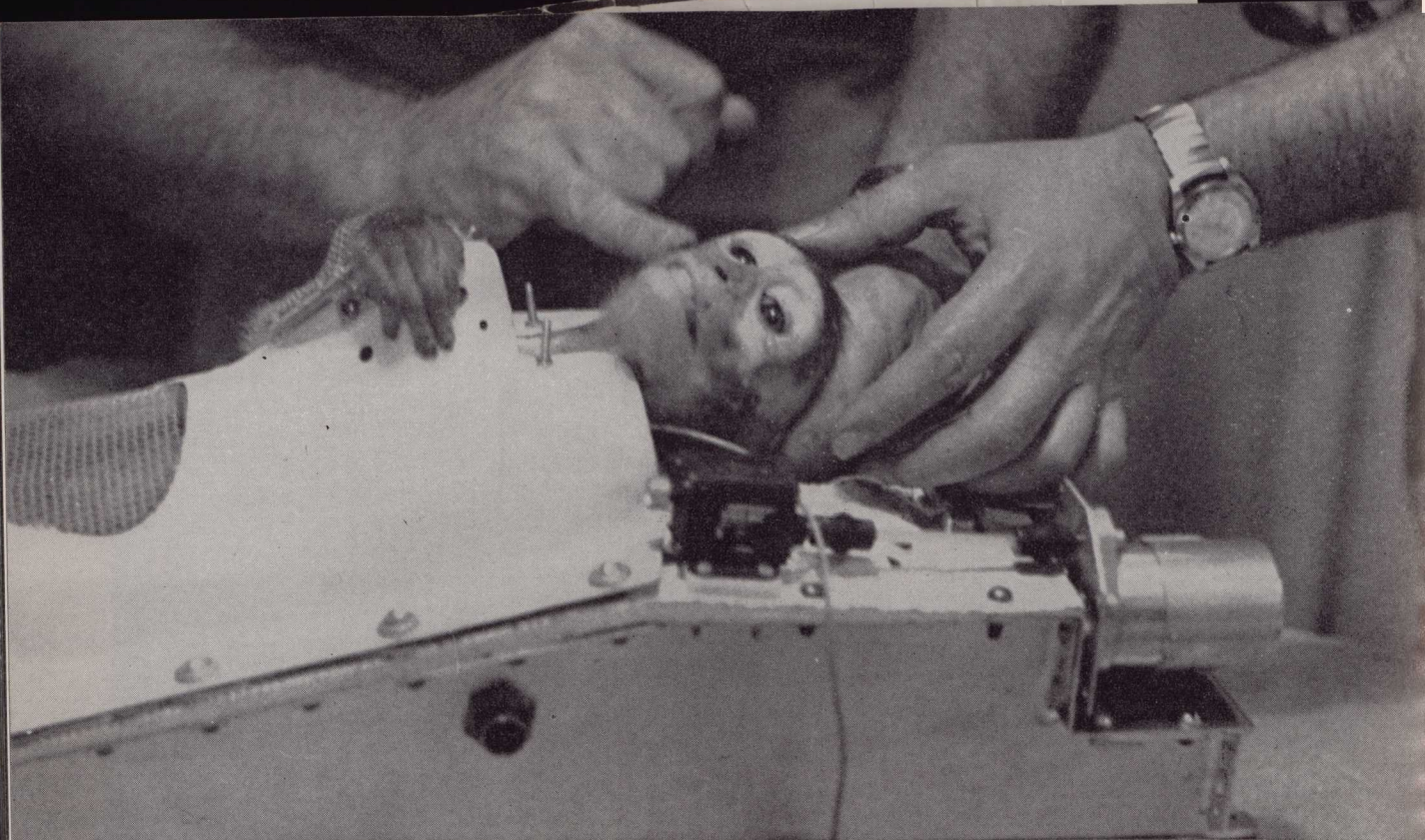
FAR SIDE OF THE MOON

THIS photograph, released by the Soviet Union on October 26th, reportedly gives mankind one of its first glimpses of the hidden side of the moon. The Russians claim this to be one of many photos taken by their moon-circling "Lunik Three" satellite and relayed back to earth via television. The picture has been diagramed to show the location of previously invisible lunar landscape features that have been named by the Russians, and also those features which were previously seen from the earth and had already been named. The area to the left of the dotted line is visible from earth, and includes the Humboldt Sea (I), the sea of Crisis (II), the Regional Sea (III), the Sea of Waver (IV), Smith Sea (V), the Sea of Fertility (VI) and the South Sea (VII). Newly-discovered areas named by the Reds are: The Sea of Moscow (1), the Bay of Astronauts (2), previously-invisible portion of the South Sea (3), Tsiolkovsky Crater (4), Lomonosov Crater (5), Joliot-Curie Crater (6), Sovetsky Mountains (7), and Mechta (Dream) Sea (8). The solid line across the moon shows its equator. The picture was transmitted by the official press agency, Tass, to its bureaus throughout the world and published in Moscow's two principal newspapers, Pravda and Izvestia.

Wide World Photos

PADDLE WHEEL SATELLITE'S PICTURE

Pictures of earth are transmitted by satellite, Explorer VI. National Aeronautics and Space Administration scientists today released what they term the first crude picture of the earth and its cloud cover. Signal pattern, directly above, was recorded at a Hawaiian tracking station August 14, while the paddle wheel satellite was 17,000 miles up in space over Mexico. Top photo shows interpretation of signal meaning superimposed on photograph of globe.

U.S. Army Photo

Grey Villet, courtesy Life © 1959 Time, Inc.

Grey Villet, courtesy Life © 1959 Time, Inc.

ABLE, BAKER-ASTRONAUTS

DURING THE 1,700 mile journey into space, the simian pair hit speeds of up to 10,000 mph and reached a peak altitude of 300 miles. For nine of the fifteen minutes they were aloft, the monkeys were weightless and exposed to a cosmic-ray bombardment. Sixty minutes after splashdown off Antigua, four Navy frogmen, smeared with shark repellent, had the buoyant cone aboard the Navy tug U.S.S. Kiowa. Major Gerald A. Champlin, an Army doctor, made a quick check and radioed: ABLE BAKER PERFECT NO INJURIES OR OTHER DIFFICULTIES.

Baker and Able had won their place in the history of space flights. The monkeys were the first living specimens to hit such speed and altitude and come back alive. Able was a patrician-looking rhesus monkey weight 7 pounds. She was the survivor of a rigorous selection program and won out over seven other original candidates in training competition at the Army's Fort Knox, Ky., Medical Laboratory and the Walter Reed Institute in Washington. Baker is a bright-eyed, long-tailed squirrel monkey with a winsome feminine white face. Weighing on the average about a pound, the breed is one of the smallest of the primate family (which includes the great apes and man). Baker also won out in an elimination contest. "These monkeys are almost volunteers," Navy Captain Ashton Graybiel explained. "During the preflight testing, we didn't force a monkey to take a test if it objected to it."

During flight, Baker and Able were models in miniature of the well-equipped spaceman. They wore molded plastic helmets and were strapped onto a Fiberglas and rubber contour couch. Both lay with their knees drawn up and backs turned to the forward end of the cone in the posture prescribed to withstand the shocks of re-entry.

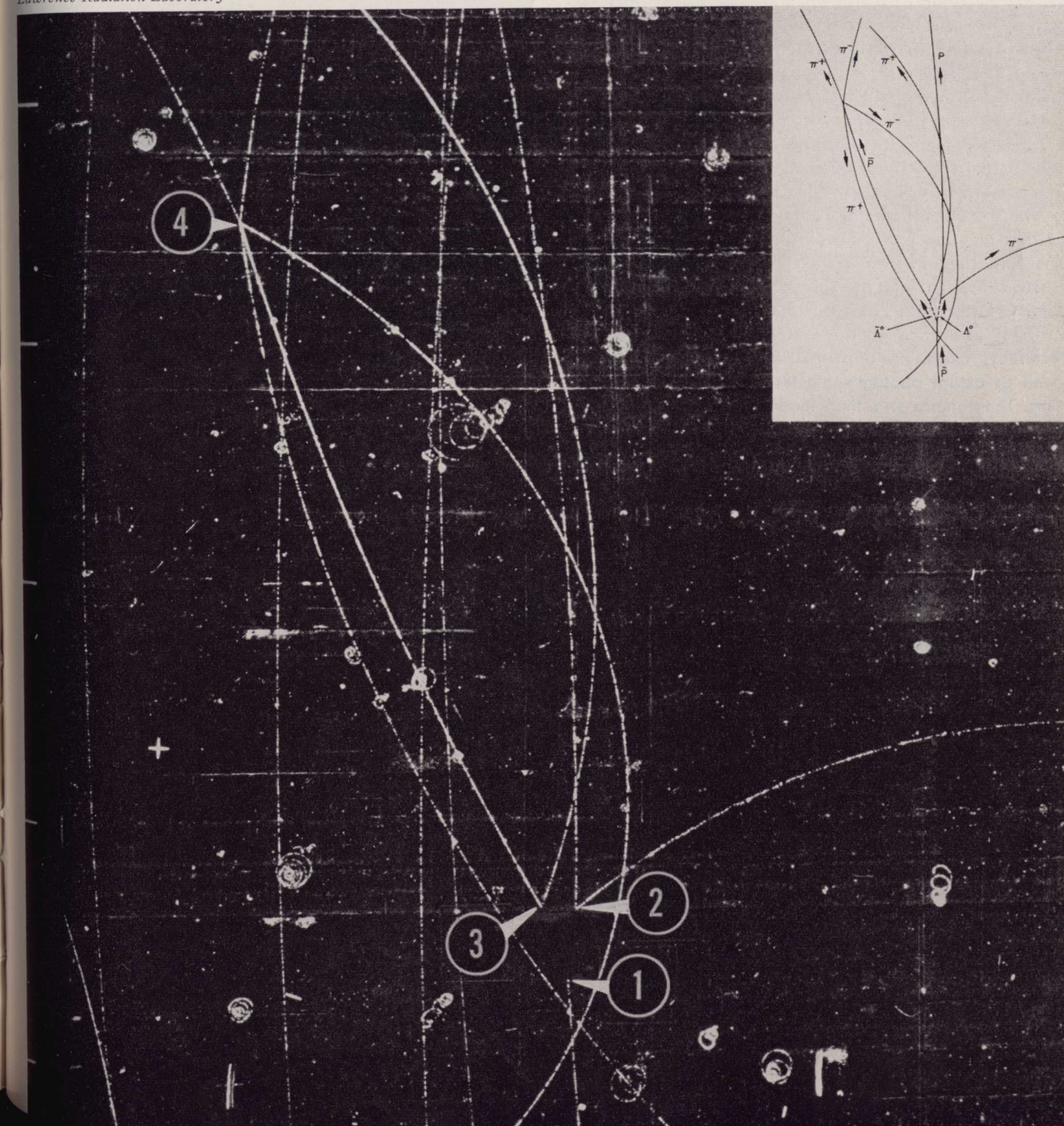
Able, America's monkey space heroine, died on the operating table at Fort Knox as Army doctors worked to remove a tiny electrode that had recorded her heartbeat during her historic ballistic missile ride. Able, before succumbing, had given proof that a primate could survive a ballistic rocket ride. But her death put a blotch on the shining record of America's greatest space biology experiment. "This is the kind of thing," said the Army's space medicine chief, "that makes you want to kick a door." Before the flight Able had taken the same trichloroethylene and suffered no harm. Yet this time she died. In trying to find out through autopsy why Able died, the scientists have acquired further detailed data on space biology. Thus in the short run Able is as valuable dead as alive. The complete story of their fabulous journey will only be known when the first Mercury man returns safely to earth.

LAMBDA SECRET DISCOVERED

LAMBDA particles are short-lived packets of matter created when high-energy protons hit protons at rest. Since each particle is presumed to have its "anti" counterpart, scientists have long been looking for anti-lambda. Faint traces of the elusive particle showed last year on photographic plates exposed to the 6 billion-volt Berkeley Bevatron, but the plates were too small to tell much of the anti-lambda story.

In the bubble chamber picture (see cut), an anti-proton from the Bevatron enters at bottom and hits a proton (1); out of the collision come one lambda and one anti-lambda particle. Since both are neutral electrically, they leave no tracks in the liquid hydrogen, but after a short, invisible career, each decays into track-leaving particles by which it can be identified. The lambda (2) turns into a proton and a negative pi meson, both of which go off the picture leaving strong curved tracks. The anti-lambda (3) turns into an anti-proton and a positive pi meson. The positive pi meson goes off the picture, but the anti-proton hits a proton (4), creating two negative and two positive pi mesons, which shoot up and down the chamber.

Identifying anti-lambdas and their relatives is no mere collecting program. The behavior of each new particle can be studied, yielding bits of knowledge not only about ordinary matter but about anti-matter as well. It may have anti-gravity threading through its masses. There is even a possibility — something to think about, at least — that in the strong world of anti-matter, time may run in reverse.

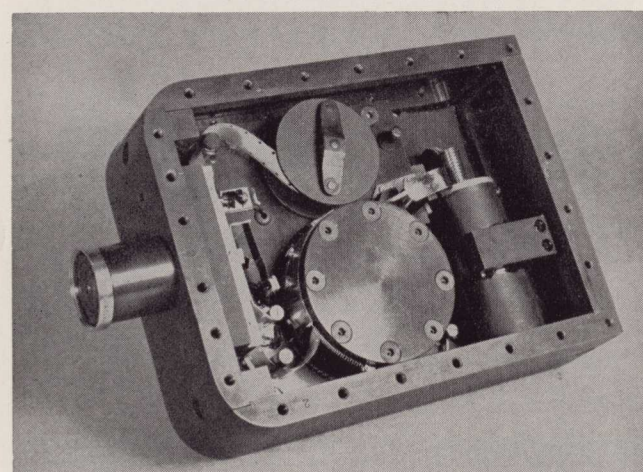
Lawrence Radiation Laboratory

FILM FROM OUTER SPACE

By Dave Rush

THE camera used to obtain the Thor separation photographs was designed, developed and fabricated by the ACR Electronics Corporation. This is a 16mm camera specially constructed to withstand shock and exposure to all environmental problems of space flight and re-entry. It measures 2½" x 6" x 8" and weighs 5 pounds. It utilizes a 10mm focal length F1.6 lens. The diaphragm had to be removed for dimension considerations and the lens barrel reworked in its entirety. The lens elements were sealed in its barrel for environmental as well as waterproofing reasons. Proper control of incident luminous energy was obtained by use of a neutral density filter (ND-3).

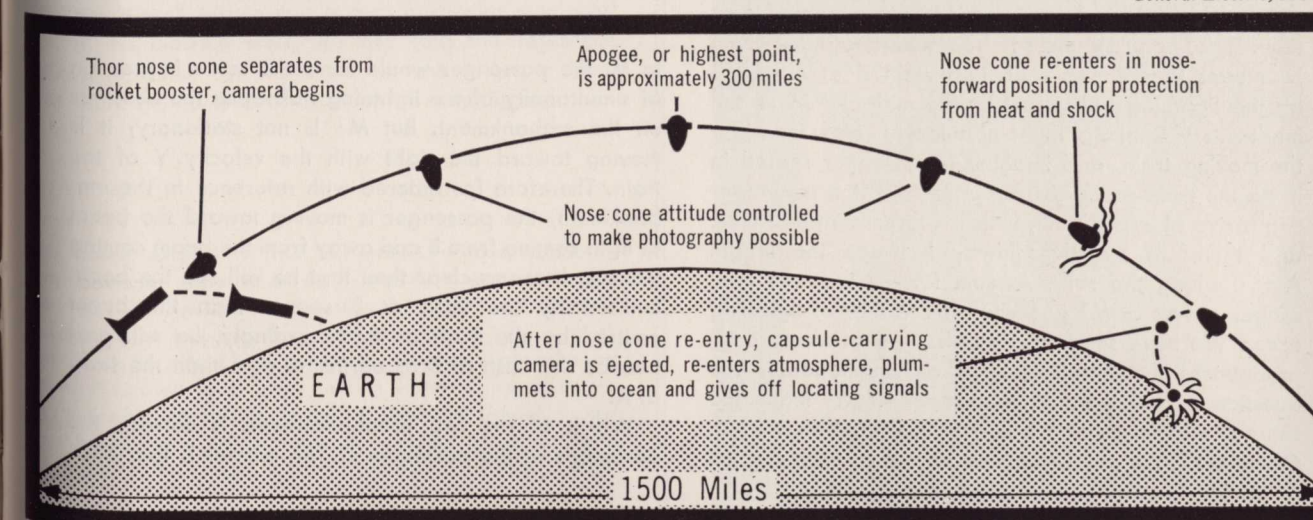
The exposure employed was 1/300 second, chosen on the basis of image blur as a function of vehicle linear and angular rates, or the effect of image motion on resolution. A frame rate of 5 frames per second was chosen to provide the necessary time-wise coverage of the flight with the available film capacity of 35 feet.

The camera was oriented within the Data Recovery Capsule with the optical axis at 90 degrees to the capsule impact axis and the capsule was assembled in the ejection assembly harness in such a way that the camera's optical axis was coincident with the nosecone roll axis.

Prior to loading the camera with the flight film, complete operability assurance environmental testing was conducted successfully, consisting of 3 axis vibration, temperature, as well as actual photographic testing and optical bench testing. The camera was then loaded with film which had been chosen after numerous tests on all types of both standard and special films. These tests were conducted to determine suitable emulsions from the standpoint of sea water immersion as well as photographic requirements. On the basis of these tests DuPont 914A was chosen because of its emulsion speed, contrast and grain structure. Although it developed that the final selection of photographic materials did not include Kodak material, the helpful cooperation and advice of the Eastman Kodak Company played an important role in the success of the program. Tests indicated that the processing of the recovered film be accomplished as soon after exposure as possible, and this requirement, coupled with the need for familiarity with the equipment, necessitated sending an Engineering Representative to the impact area to await the recovery of the data capsule. Portable facilities and the necessary chemicals were carried with the specialist involved and with the excellent cooperation of the Guided Missile Division of Pan American Airways, The Base Commander at Antigua, the Air Force Ballistic Missile Florida representative and the General Electric MSVD Flight Test Organization, very satisfactory results were obtained.

After the recovered data capsule was received, the facilities were prepared for complete processing of the film. Temperature measurements were made of ocean water and the cold water supply at the base. These readings were 75°F and 82°F. The readings indicated that problems with developing temperature and emulsion state were to be expected. A supply of ice was obtained for use in cooling solutions. After all preparations were completed, the camera was removed from the data capsule — approximately 21 hours after impact into the ocean. Examination of the camera indicated that relatively little damage had incurred through impact. The take-up magazine was removed and a section of film approximately 2 inches long was removed and processed in Ethol UFG developer at 65° for 4½ minutes. The inspection of this strip indicated proper time temperature usage and the rest of the film was processed. The test strip indicated that the emulsion was in a very soft state, so the film was washed repeatedly in ice water at approximately 50°F. Photos obtained from this flight were of good quality from an instrumentation point of view since the prime objective was to optically measure the performance of the missile. Future plans are to change the optics and films for pictorial photographic data.

General Electric, MSVD

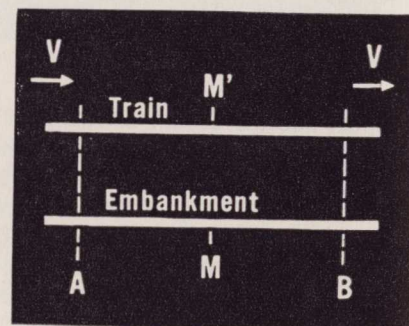
AN INSIDE look at ACR Electronics 16-millimeter movie camera, which for the first time showed Earth from altitudes up to 300 miles plus an important part of the missile's own flight.

Photos taken with the ACR Mark II camera, made under subcontract for GE's Missile and Space Vehicle Dept.

ASTRONAUTS RAISE HANDS TO SHOW THAT THEY ARE CONFIDENT THAT THEY WILL COME BACK FROM OUTER SPACE. FROM LEFT: DONALD SLAYTON, ALAN SHEPARD, WALTER SCHIRRA, VIRGIL GRISSOM, JOHN GLENN, LEROY COOPER AND MALCOLM CARPENTER

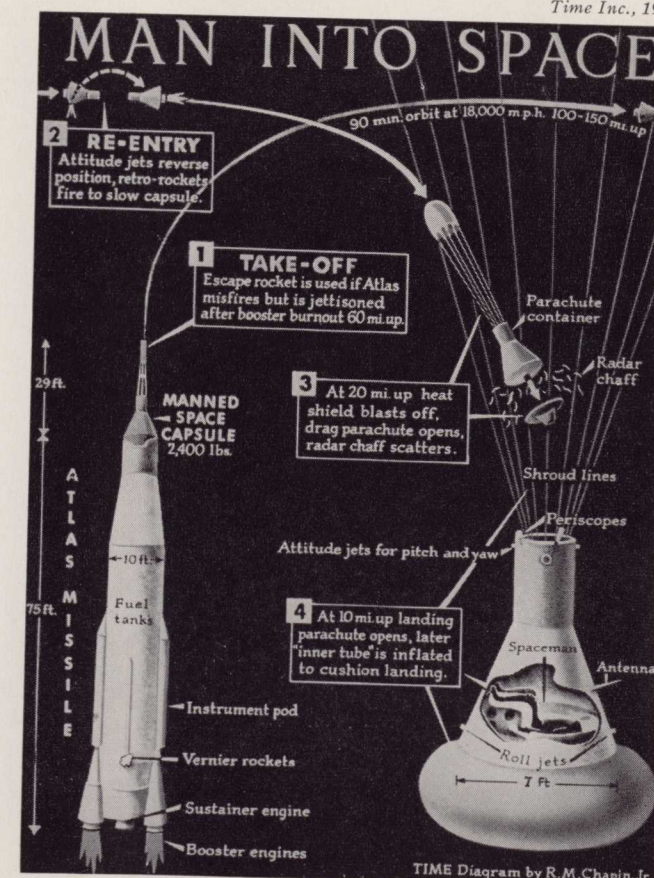
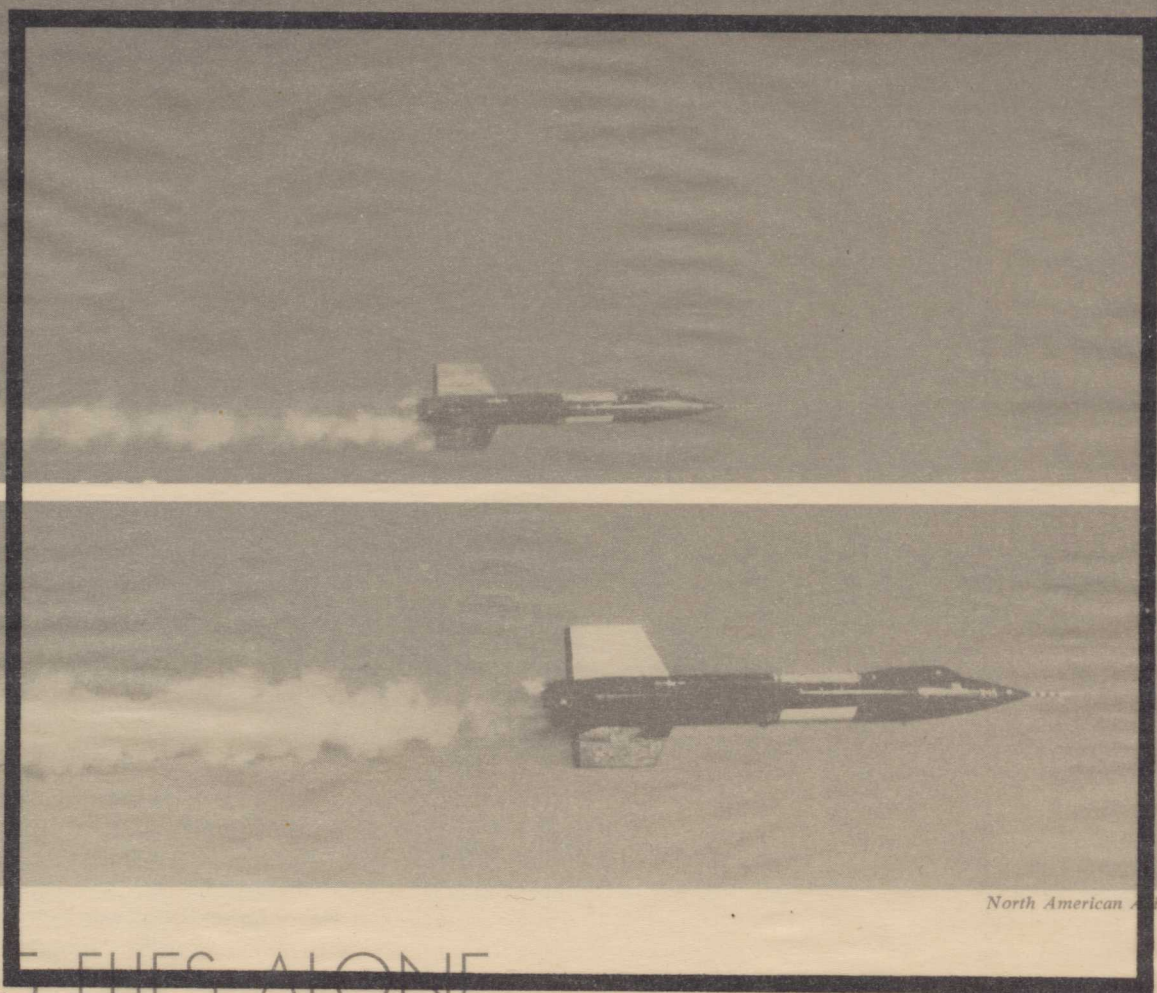
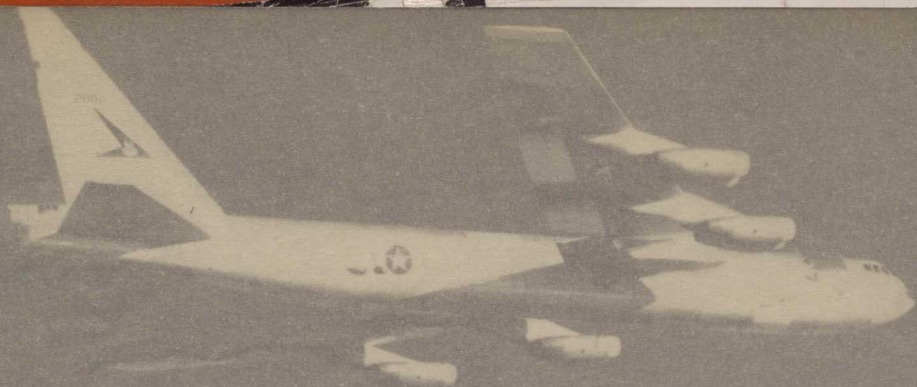
The ASTRONAUTS

THE seven men with their hands raised in the picture above were the cream of the crop and, as they sat there at a press conference, the country was introduced to the first American, perhaps the first human being, who will orbit in space. These are the Astronauts, pioneers picked for our first efforts at manned space flight. Which of the smiling, clean-cut men it would be, no one knew. But sometime in the next two years, one of them will be rocketed on a journey that has been eloquently described by a Navy doctor, Captain Norman Barr: "The crushing force (of acceleration) will shove the air out of his lungs. . . . He will wait in heavy silent oppression. Then (in orbit) he will have dropped suddenly, as if over a precipice, into a still and weightless world. . . . Finally the vehicle (will) plunge back . . . and crash into the atmosphere like a stone in water . . ." and come to earth. If he does not survive, one of his six remaining comrades will go next. The seven knew these hazards. Yet when asked for a show of hands by those who thought they would come back alive, the answer came (above) unhesitating, unanimous. Their ages range from 32 to 37, their I.Q.'s run high, from 134 to 147. And, they all share an overpowering eagerness to be first into space. As James Reston commented in a *New York Times* article, it was exciting to hear them talk of the heavens the way old explorers talked of the unknown seas. "They wanted to see what was on the other side," he noted, and their remarks about duty, faith and country came out of deep-felt idealism and courage.

Einstein's Own Example of the Relativity of Time

THE diagram shows a long railroad train traveling along the rails with velocity V, in the direction toward the right of the page. The bottom line denotes the embankment running parallel to the rails. The letters A and B mark two places on the rails, and the letter M marks a point on the embankment directly midway between A and B. At M stands an observer equipped with a pair of mirrors which are joined in a V and inclined at 90°. By means of this device he can observe both places, A and B, at the same time. We imagine two events at A and B, say two flashes of lightning, which the observer perceives in his mirror at the same time. These he pronounces to be *simultaneous*, by which he means that the rays of light emitted at A and B by the lightning bolts meet at the midpoint M of the length $A \rightarrow B$ along the embankment. Now consider the moving train, and imagine a passenger seated in it. As the train proceeds along the rails, the passenger will arrive at a point m^1, which is directly opposite M, and therefore exactly midway between the length $A \rightarrow B$ along the rails. Assume further that the passenger arrives at M^1 just when the flashes of lightning occur. We have seen that the observer at M correctly pronounces the lightning bolts as simultaneous; the question is, will the train passenger at M^1 make the same pronouncement? It is easily shown that he will not. Obviously if the point M^1 were stationary with respect to M, the passenger would have the same impression of simultaneity of the lightning flashes as the observer on the embankment. But M^1 is not stationary; it is moving toward the right with the velocity V of the train. Therefore (considered with reference to the embankment) the passenger is moving toward the beam of light coming from B and away from the beam coming from A. It seems clear then that he will see the beam emitted by the flash at B sooner than the beam emitted by the flash at A. Accordingly, he will pronounce the flash at B as *earlier in time* than the flash at A.

Which of the two pronouncements is correct, the observer's or the passenger's? The answer is that each is right in its own system. The observer is right with respect to the embankment, the passenger with respect to the train. The observer may say that he alone is right because he is at rest while the passenger is moving and his impressions are therefore distorted. To this the passenger can reply that motion does not distort the signals, and that in any case, there is no more reason to believe that he was moving and the observer at rest than that the passenger was at rest and the observer moving.

There is nothing to choose between these views, and they can be logically reconciled only by accepting the principle that simultaneity of events is meaningful only with respect to a particular reference system; moreover, that every such system has its own particular time, and unless, as Einstein says, we are told the reference system to which the statement of time refers, a bare statement of the time of an event is meaningless.

The above excerpt is from an article entitled, Einstein's Great Idea by James R. Newman and first appeared in the May 16, 1959 issue of The Saturday Evening Post. The entire article will be included in a book Adventures of the Mind, published by Alfred A. Knopf. Mr. Newman has achieved equal distinction as a lawyer and a writer on mathematics. In the former capacity he taught at Yale Law School, served as advisor to the White House on scientific legislation, and as counsel to the Senate Special Committee on Atomic Energy.

North American Aviation, In[illegible]

X-15 FLIES ALONE

It was an important day for the X-15, the United States rocket plane which is designed to take man into the lower reaches of space. Shaped like a missile, but carrying a man in its tiny cockpit, the X-15 had seven times before been shackled under the wing of a huge B-52 jet bomber and carried aloft to test its design. On one of these flights it had been released and glided back to earth without fuel. Now, on this trip, it was to fly for the first time under its own power.

The B-52 carried it up to 38,000 feet above Edwards Air Force Base in California, then cut it loose. The X-15 dropped. "He's got a light!" shouted a fighter pilot who flew nearby to observe the X-15. Vapor poured from the plane's tail and showed that the engines had caught o[n]. "I'm heading uphill at 33,000," Pilot Scott Crossfiel[d] radioed. For three eventful minutes, which is all it too[k] for the X-15 to gulp up its 18,000 pounds of fuel, Cros[s]field put it through its paces, tested its controls, too[k] it up to 50,000 feet and level off at a top speed [of] 1,400 mph. Then, coming in on a 100-mile arc, he glide[d] to a perfect landing.

The X-15 performed so well that its engineers are co[n]fident it will have no trouble making its maximum planne[d] altitude (100 miles) and speed (4,000 mph) on futur[e] flights. Its chief engineer, Harrison Storms, is already wor[k]ing on plans to make it go even higher and faster than tha[t].

IN MEMORIAM

DAN WEINER

LISA LARSEN

PAUL OUTERBRIDGE